Claims

1. A method of analyzing an image of a substance deposited onto a substrate, the image comprising a plurality of pixels, the method comprising:

defining a region of interest in the image;

associating the region of interest with first and second perpendicular axis, wherein a set of pixels in the image lie along the first axis;

converting the pixels in the region of interest to a single dimensional array aligned with the first axis and projecting along the second axis; and

applying at least one threshold to the single dimensional array, the threshold based at least in part on a predetermined limit.

2. The method of claim 1 further comprising smoothing the single dimensional array.

3. The method of claim 2 wherein smoothing includes specifying at least one of a maximum amount of substance in the region of interest, a degree of smoothing, and a maximum amount of substance deposited on the substrate.

4. The method of claim 1 wherein converting comprises:

computing, for each pixel along the first axis, a sum of all the pixels in the region of interest that are in perpendicular alignment with the respective pixel along the axis; and

representing the sums of each pixel along the axis as a single dimensional array perpendicular to the second axis.

5. The method of claim 1 further comprising locating an axis substantially near one edge of the regions of interest, wherein a set of pixels in the image lie along the axis.

6. The method of claim 1 further comprising evaluating the single dimensional array to determine whether any features exist in the region of interest.

7. The method of claim 6 wherein the features include defects, short circuits, bridge-like features, bridges, excess quantities of the substance, stray areas of the substance, and poorly defined areas of the substance.

8. The method of claim 6 further comprising receiving at least one detection parameter, the detection parameter relating to determining the likelihood that the at least one feature in the image could later result in a functional defect.

9. The method of claim 8 wherein the step of evaluating is accomplished in accordance with the at least one detection parameter.

10. The method of claim 9 further comprising computing, for each feature in the region of interest, the area and geometry of the feature, the computation accomplished at least in part using the detection parameter and the single dimensional array.

11. The method of claim 10 further comprising determining, based on the area and geometry, the likelihood that the at least one feature in the image could later result in a functional defect.

12. The method of claim 11 further comprising modifying a process by which the substance is deposited on the substrate based on the determined likelihood that the at least one feature in the image could result in a functional defect.

13. The method of claim 1 wherein the substrate comprises a printed circuit board.

14. The method of claim 1 wherein the substance comprises an electronic material.

15. The method of claim 1 wherein the substance comprises solder paste.

16. The method of claim 1 wherein the image comprises a digitized image.

17. A method of inspecting a substrate having a substance deposited thereon comprising the steps of:

depositing the substance onto the substrate;

capturing an image of the substrate;

detecting variations in texture in the image to determine a location of the substance on the substrate;

defining a region of interest in the image, the defined region of interest having a first axis, wherein a set of pixels in the image lie along the axis;

computing, for each pixel along the axis, a sum of all the pixels in the region of interest that are in perpendicular alignment with the respective pixel along the axis;

representing the sums of each pixel along the axis as a single dimensional array perpendicular to the axis; and

evaluating the single dimensional array to determine whether any features exist in the region of interest.

18. The method of claim 17 wherein the features include defects, short circuits, bridge-like features, bridges, excess quantities of the substance, stray areas of the substance, and poorly defined areas of the substance.

19. The method of claim 17 further comprising receiving at least one detection parameter, the detection parameter relating to determining the likelihood that the at least one feature in the region of interest could later result in a functional defect.

20. The method of claim 19 wherein the step of evaluating is accomplished in accordance with at least one detection parameter.

21. The method of claim 20 further comprising computing, for each feature in the region of interest, the area and geometry of the feature, the computation accomplished using at least one detection parameter and the single dimensional array.

22. The method of claim 21 further comprising determining, based on the area and geometry, the likelihood that the at least one feature in the image could later result in a functional defect.

23. The method of claim 17 wherein the substrate is a printed circuit board.

24. The method of claim 17 wherein the substance includes solder paste.

25. A system for dispensing solder paste at a predetermined location on a substrate comprising:

a dispenser that dispenses material on the substrate;

a controller for maintaining the operations of the dispenser; and

a processor in electrical communication with the controller, the processor being programmed to:

perform texture-based recognition of a solder paste deposit located on the substrate,

define a region of interest within the image of solder paste, the defined region of interest having a first axis, wherein a set of pixels in the image lie along the axis;

compute, for each pixel along the axis, a sum of all the pixels in the region of interest that are in perpendicular alignment with the respective pixel along the axis;

represent the sums of each pixel along the axis as a single dimensional array perpendicular to the axis; and

evaluate the single dimensional array to determine whether any defects exist in the region of interest.

26. The system of claim 25 wherein the substrate is a circuit board.

27. The system of claim 25 wherein the defects include short circuits, bridges, excess quantities of solder paste, stray areas of solder paste, and poorly defined areas of solder paste on the substrate.

28. The system of claim 25 wherein the processor is further programmed to compute, for each defect in the region of interest, the area and geometry of the defect, using a detection parameter and the single dimensional array.

29. A method of detecting a defect in a substance deposited on a substrate, comprising:

capturing an image of the substrate;

detecting variations in texture in the image to determine a location of the substance on the substrate;

defining a region of interest in the image, the defined region of interest having a first axis, wherein a set of pixels in the image lie along the axis;

computing, for each pixel along the axis, a sum of all the pixels in the region of interest that are in perpendicular alignment with the respective pixel along the axis;

representing the sums of each pixel along the axis as a single dimensional array perpendicular to the axis; and

evaluating the single dimensional array to determine whether any defects exist in the region of interest.

30. The method of claim 29 wherein the substance comprises solder paste.

31. The method of claim 30 wherein the defect comprises at least one of a solder bridge, bridge-like feature, or excess paste feature.

32. The method of claim 31 wherein the substrate includes first and second pads onto which the solder paste is deposited and the defect comprises the existence of solder paste spanning at least a portion of the distance between the first and second pads.

33. The method of claim 32 further comprising applying a rule to determine whether the defect should be classified as a solder bridge.